LUBRICATION

A Technical Publication Devoted to the Selection and Use of Lubricants

Published Monthly by

The Texas Company, 17 Battery Place, New York City

Vol. VI. November, 1920 No. 10

Change of Address: In reporting change of address kindly give both old and new addresses.
Permission to Reprint granted on request, provided article is quoted exactly and credit given to "Lubrication."

Lubrication in the Rubber Industry

ALTHOUGH Charles Goodyear discovered the secret of the vulcanization of rubber in 1839, it was not until the last decade of the nineteenth century that rubber came into its own. At that time the market for bicycle and carriage tires started a demand, which, due to the automobile chiefly, has grown until today we class rubber with the leaders of commodities. When we consider that it received the initial impetus toward its present position less than thirty years ago, the rise of the industry appears phenomenal.

However, due to this quick rise and the fact that the industry is so closely centralized, which fact tends to cause more centralized interest, there is probably less concrete information disseminated on the subject of rubber plant operation in proportion to the importance of the product than exists concerning any other commodity.

An industry which touches practically every phase of our lives, as rubber does, is well worthy of more than passing note. Call to mind packing, belting, hose, raincoats, boots, soles, heels, suspenders, buttons, office equipment, pipe stems, telephone instruments, electrical wiring, balloons, sporting goods, bandages, doctor's and dentist's supplies and a thousand other rubber articles with which we come in daily contact and you have only started to realize what this product means to humanity. One concern boasts of making thirty thousand articles. How then is rubber made to yield these products, what are the machines used and how is the lubrication of these machines accomplished?

Crude Rubber

Crude rubber is a vegetable product gathered from certain species of trees, shrubs, vines and roots, in much the same way that maple sap is gathered. The difference in the nature of gathering is that while maple sap comes from the body of the tree, the latex from which rubber is derived, comes from the bark of the growth. The latex is coagulated and when received at the factory it has generally been partly purified and arrives in bundles of sheets. Some grades, however, are received in lumps or biscuits. That which has been coagulated by smoking is black having an odor like smoked ham, while that which has been coagulated by

means of acetic acid is yellow and has the rubber odor.

Washing

Upon taking the raw rubber from the factory storage it is still further washed. To do this it is cut into small pieces either by hand or by shears. The shears are simple in design and the oil used for general lubrication is the one used, unless the unit be gear driven, in which case a gear lubricant is required for the drive. The small pieces of raw rubber are soaked in warm water in softening vats for several hours, from which they go to the "cracker" and then the "washer" or washing machine.

The purpose of these machines is suggested by the names—to crack and wash the crude rubber. Another affect is to chew the rubber, forming flat sheets which facilitates handling and drying. The designs of both the "cracker" and the washing machine are alike, the only difference between them being in the surfaces of the rolls. Those of the "cracker" are cross-spiralled while those of the washer are single-spiralled or grooved. It will be noted from the illustration that the design is simple. The parts working the rubber consisting merely of the rolls. These rolls are from 8½″ to 18″ in diameter and from 15″ to 36″ in width. The speed of the machines rarely exceeds 40 revolutions per minute. The rolls are generally made of hard sand cast iron but chilled rolls are sometimes used.

Obviously the rolls revolve inward on top and are geared to work at different speeds which causes a grinding or chewing of the small pieces of crude rubber fed between them. Running water is maintained on the work at all times so that as the machine completely tears apart the particles of crude rubber, the sand, dirt and other impurities are washed out. The water also carries away the generated heat which, if not removed, would affect the life of the rubber. After all of the rubber has passed through the cracker a sufficient number of times, the sheet which it has formed on the roll is removed and a like operation is performed by the washer. Due to the fact that the rolls of this unit are single spiralled or grooved, the action here is less severe but nevertheless purifying. After leaving the washing machine, the sheets are hung in a drying room, where they are thoroughly desiccated.

The parts of the "cracker" and washing machine requiring lubrication are the roll bearings, shaft bearings, clutch slide, the adjusting screw and the gears. The boxes are generally bronze lined with oil grooves for the distribution of the lubricant and fitted to ordinary clearances. It is to be noted that adjusting screws are fitted to regulate the pressure between the rolls. Which means that nobody knows just what the bearing pressures are going to be as the operators adjust these to fit the needs of the work. However adjusted, nevertheless, the work in the machine forces the rolls apart causing high pressures on the outboard sides of the bearings. As before mentioned, the speeds are slow. As the water carries away the heat generated by the work, there is fortunately none of the working or frictional heat of the roll to contend with. To specify the best lubricant for these units would cause criticism from a large percentage of the rubber plant executives since each one seems to have ideas of his own on the subject. Sufficient then to say that the practice of most of the machinery producers is to furnish the machines with oil cups but admitting that they do not recommend oil in preference to grease. When oil is used there is another division of opinion but it is found that a heavy red engine oil will meet all of the lubricating requirements. Many of the large rubber manufacturers, however, experience better results when using a medium bodied, well compounded grease. This seems to be simply a matter of opinion.

It has been found that the power requirements of these machines demand gear drives so that belt driven machines have long been obsolete. The gears are generally moulded but the connecting gears are sometimes machined. The lubrication of the driving gears is generally open, but bath lubrication from a pan under the connecting gears is the general rule for these parts. The lubricant used should be a well refined, heavy bodied, gear grease, high in adhesive properties and without caking or gumming tendencies. With such a product it is found unnecessary to apply the lubricant

more often than twice a week to insure satisfactory lubrication, while ordinarily once a week is sufficient.

The heavy adjusting screws are generally of steel working in bronze nuts. To insure easy adjustment these should be given an occasional application of cup grease.

Compounding

From the drying room, the rubber which has been washed and dried goes to the compounding room. Here the different materials which determine the properties of the finished product are proportioned to the raw rubber and the whole placed in pans which are sent to the mixing machines. These materials are worth considering at this point for they have a decided effect on lubrication, due to the dirty condition they cause in the mills. The precipitation of dust sometimes runs as high as one sixteenth of an inch per week in the mixing room. It is of interest to note also the affect of the different products.

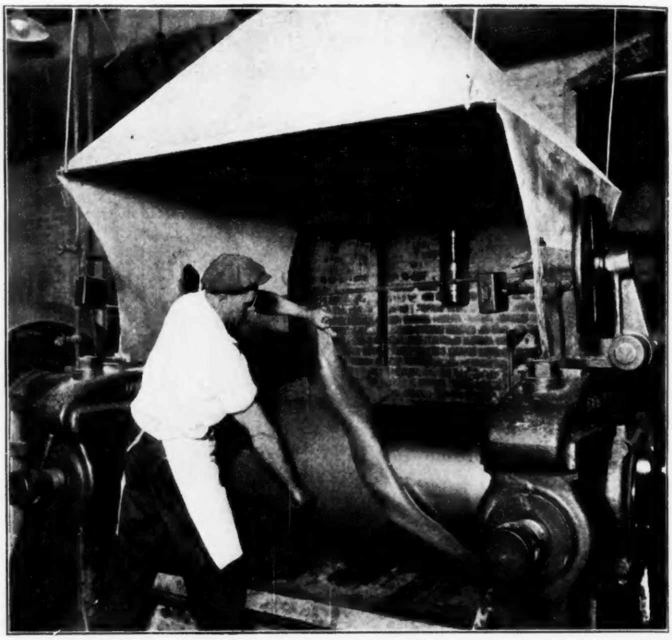
All companies do not use the same compounding materials but it is interesting to note a few of the mixtures. It is necessary to employ sulphur in all products to be vulcanized. It is the sulphur, together with the application of heat and pressure, that makes vulcanization possible. To decrease the time consumed in vulcanization, "accelerators" are used among which are heavy calcined magnesia, light magnesia and lime. The rubber companies zealously guard their compounding secrets of the kinds and amounts of the accelerators used.

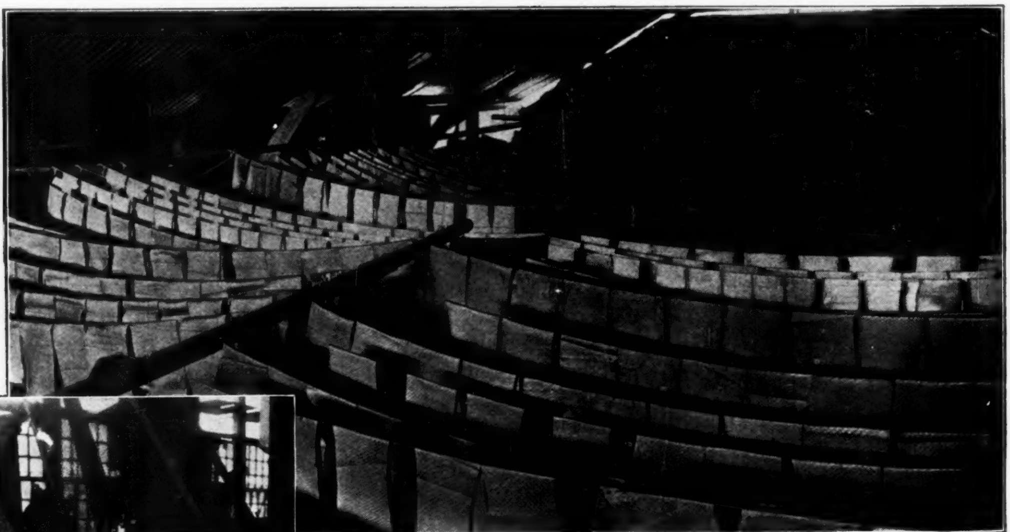
Metalized rubber for high pressure valve discs include pulverized metallic lead, zinc and antimony; while wood cellulose is sometimes mixed with rubber to be used for clothing to make it proof against perspiration. Sulphur, camphor and copal are used to make hard rubber or ebonite. We have all walked on rubber floors in which powdered cork is mixed. Powdered emery with sulphur and rubber enter into a grinding composition, while a mixture of rubber, ruby shellac, calcined magnesia, and pentasulphide of antimony can be made into artificial whalebones, gun stocks and surgical splints. Materials for coloring such as burnt amber, lampblack, lithopone, and antimony sulphide are used.

Mixing

A thorough and intimate mixing of the rubber with the compounds is imperative. This is accomplished in the mixing machines or "mills." It will be noted that the construction is very similar to that of the crackers and washers. Here, however, no water is used. The surfaces of the rolls are polished and they are cast hollow and fitted with steam connections and cooling water so that the temperature is closely controlled, the purpose being to make the work plastic to facilitate mixing and also to cause the work to adhere to one roll only while passing through the rolls. The control of the temperature is necessarily close on account of the effect which it has on the properties of the material worked. In general, the rolls are larger than those of the cracker, being usually from 15″ to 28″ in diameter and from 36″ to 84″ long. Due to the fact that the rolls are geared to run at different speeds, the plastic dough is thoroughly kneaded. The rubber is first thrown into the mill and when plastic the compounds are added in small amounts and the work kept in the mill until the operator is convinced that the mixture is complete, at which time it is sliced from the roll with a lengthwise cut.

On the mills, or mixers, we have the same parts to lubricate as on the cracker, but we have added facts to consider. The pressures on the bearings are abnormal and probably as high as are to be found on any class of machinery; in fact, it is so high that the breaking of rolls having a six or seven inch wall is an occasional occurrence. Operators have been known to use a seven-foot bar to adjust the screw on the bearings, besides which we have additional bearing pressure caused by expansion due to the steam heating of the rolls and further than these two there is the bearing pressure caused by the work forcing the rolls apart. One executive in charge of the lubrication of a large rubber plant states that the pressure on these bearings exceeds 500 tons on 84″ mills with 17″x20″ boxes, but this is a guess as nobody knows just how high it does go. The speeds





PHOTOGRAPH NO. I
Gathering Rubber. Note incisions on bark of tree.
Firestone Tire Company.

PHOTOGRAPH NO. II
Mixer showing operator cutting stock from roll.
McGraw Tire Company.

PHOTOGRAPH NO. III
Drying Room.
Firestone Tire Company.

PHOTOGRAPH NO. IV
Vulcanizer.
Firestone Tire Company.

are low, running below 40 revolutions per minute, and the operating temperatures high, due to the conducted steam heat and the atmospheric temperature.

The necessity for cleanliness on all machinery handling rubber is great. While oils are sometimes used, such as linseed oil and mineral hydrocarbons which act as fluxes or to soften uncured stocks, the addition of the lubricants must be avoided for they destroy certain properties, particularly if they are allowed to contaminate the sheet of rubber already compounded. The precipitation of the dust from the compounds must also be considered in a discussion of the gear lubricant.

An ideal lubricant for the journals of the rolls would be a well refined oil having a universal viscosity of 150 seconds at 210° F. But on account of the market conditions we find a large majority of machinery manufacturers and rubber plant executives advising the use of a medium bodied, well refined grease instead of an oil. This is generally applied from spring compression cups feeding to the low pressure side of the box which is usually bronze lined, properly cut with oil grooves. These oil grooves should not be carried to the high pressure side of the bearing for that surface should be perfectly smooth giving a maximum of bearing surface and offering an unbroken lubricating film.

Many of the popular mills are furnished with grease pockets in the boxes. It has been found that some plant engineers make a matting of lamp wick to place next to the journal in the slotted pockets and use a lighter grease. This practice is not to be recommended as some of the wicking will eventually wear down into the bearing tending to clog the oil grooves. Further, all practices should be avoided which make possible the introduction of foreign matter into the bearing. When the grease pockets are used, the bearing is generally provided with means for the introduction of oil either to help the grease or to start it under adverse conditions.

In selecting the proper gear lubricant, a happy medium must be struck in obtaining one light enough to absorb considerable dust before it rolls up into balls and throws off, and one heavy enough to withstand the bearing pressures on the teeth, thereby maintaining the lubricating film for periods up to one week. Where the precipitation of dust is particularly severe, it is natural to assume that applications must be made more frequently. Bear this in mind however—that the heavier grades used under clean operating conditions cannot be expected to maintain a lubricating film under the ordinarily dirty conditions found around the mixers. A lighter grade will last longer and yield better results.

Where pans are furnished for bath lubrication on the connecting gears, they should be cleaned out at regular intervals for the dust destroys the adhesiveness of the grease, tending to form a solid pasty mass which the gears cannot pick up. The gear grease should have no natural tendency to harden or cake and should be of sufficient body to prevent the metallic contact of the gears at all times.

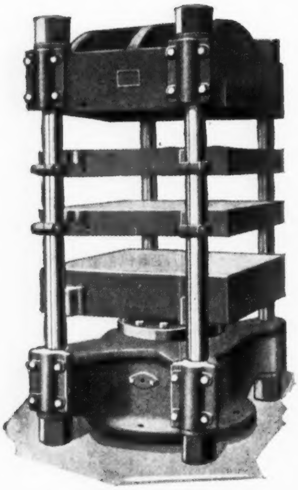
The adjusting screws should be kept in free working condition by the occasional application of a cup grease. If a sliding clutch is fitted the slide should also be well greased. The shaft bearings are taken care of by the engine oil used for general lubrication.

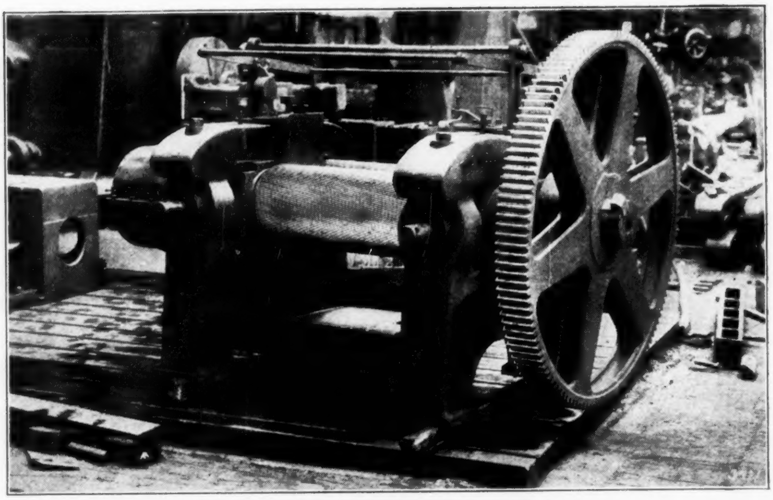
Since the Banbury mill is still little used, it will not be discussed here.

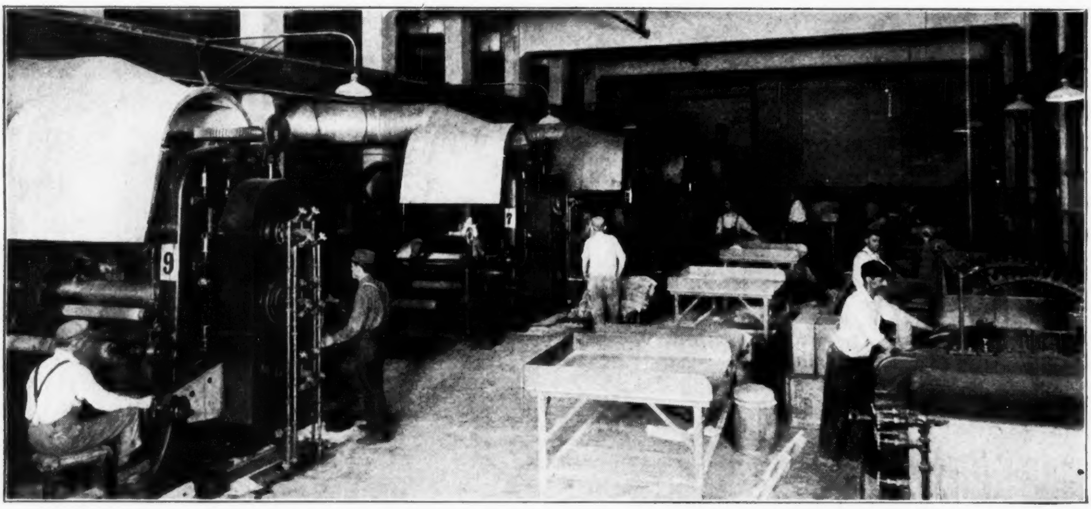
Calendering and Spreading

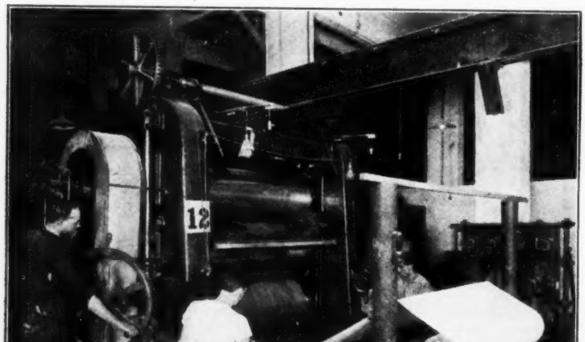
All crude rubber coming into the factory follows the process already described, but from this point there are three general methods of handling. It is calendered, moulded, or forced through a tubing machine. Again it may be placed in a solution and spread in this form on fabric for various purposes. Too, some of it is dissolved in naphtha to make rubber cement, but the main courses followed from the mixers are the three first mentioned.

A three-roll calender is shown in the figure. This machine is capable of very fine adjustment and its purpose is to spread the rubber dough to a certain definite thickness or to impregnate fabric with the dough, applying it in a fixed thickness. The green stock of rubber to be









PHOTOGRAPH NO. V

Hydraulic Press.
Birmingham Iron Foundry.

PHOTOGRAPH NO. VI

Washer (shop view).
Wellman Seaver Morgan Company.

PHOTOGRAPH NO. VII

General view of calender room. Mixers at the right of picture.
Firestone Tire Company.

PHOTOGRAPH NO. VIII

Close-up of calender showing rubber stock being rolled up with fabric.
Firestone Tire Company.

used on the calender is first brought to a plastic state on a small warming roll and is then fed between the two upper rolls of the calender, adhering to the middle roll. If the rubber is to be applied to fabric, the fabric is run between the bottom and the middle rolls with the sheeted dough. The rubber is actually ground into the fabric. The fabric leaving the rolls is spoken of in the trade as "friction." This is used in the manufacture of pneumatic tires, hose, belting, etc. In making "friction" for tires, the necessity for keeping the thickness constant is shown by the defects which appear after little use of the finished product. For the products named above the rolls are polished, but when it is desired to make special shapes for products such as boots, shoes, etc., the rolls are engraved so that the work when it leaves the calender has imprinted on it the shape and thickness of the product being manufactured.

Products made from "friction" include balloonette cloth, tentings, belts, hose, boots, shoes, mackintoshes, and many other products.

If the rubber is to be used for a product which does not include the use of fabric, the purpose of calendering then becomes to roll the rubber to a uniform thickness. In this case, a liner cloth is fed between the bottom and middle rolls with the rubber sheet in order to prevent rubber sheets sticking together, but the rolls are adjusted so that the rubber is not ground in, being simply wound up in the liner cloth from which it is removed upon reaching the machine in which it is to be used. Products made by this method, which includes stamping from the rubber sheet, are rubber heels, inner tubes, toy balloons, bathing caps, horse shoe pads, tobacco pouches, many druggists' sundries, etc.

The lubrication of the calenders resembles that of the mills closely. Here again we have heating and cooling connections to the hollow rolls for the purpose of temperature control, causing high temperatures on the journals. Three general methods of lubricating the roll necks are now in vogue. These are: Using a heavy oil, grease from a compression cup, or grease from a grease pocket in the box. In selecting oil, some select a heavy red engine oil while others choose the cylinder stocks. Either will do the work as the bearing pressures are not excessive, although the speeds do not exceed 40 revolutions per minute and the temperatures reach 200° F. The market prices and the consumption of the oils are the largest factors in deciding between the two. Many calenders are fitted with grease pockets in the boxes and oil cups which are there to be used regularly or in case of emergency. This is a good condition if the operators can be trusted to handle the lubricants judiciously without constant supervision.

The units on which the grease is used, either from cups, pockets, or slotted bearings, do not give trouble when the correct grease is properly used. However, there is no available data for comparison of the relative repair bills to determine the best lubricating practice from the repair standpoint. Further there is no harder test for a grease than that of service in a grease pocket. Trouble is bound to follow the use of an improper grease due to the fact that the heat causes the oil to separate from the soap.

The importance of keeping the work uniform in the calender was emphasized above. As improper lubrication directly influences the uniformity of the work, since it causes wear on the bearings, its importance can be appreciated. The boxes are generally of cast iron with bronze liners. These are generally so designed that they afford a large bearing surface with consequent normal or subnormal pressures and some means of readily taking up the wear.

The same lubricant used on the gears of the washers, crackers and mills should be used on the gears of the calender.

Another method of treating fabric is that of "spreading." The "spreader" is the machine used for this operation. The cloth to be treated is pulled by a roller located on the finishing end of the machine, between a hard roller and a knife edge at the other end. Before passing between the roller and knife edge, rubber cement is poured on the cloth, the knife edge scraping all but a thin coat off. Between the knife edge and the finishing end is a large steam chest, the function of which is to evapor-

ate the naphtha in the cement. At the finishing end the fabric is rolled up with a liner cloth to prevent the work from sticking together. Several coats of cement are generally applied before the fabric is ready for the purpose desired.

A heavy engine oil is used on the bearings of these machines. However, excepting the high atmospheric temperature prevailing in the vicinity of the machines, there are no conditions which make the lubrication of the simple bearings difficult.

Molded Rubber

When one speaks of molded rubber goods, many people instantly conceive of melting the rubber and pouring it into molds. This is not the method used. When the rubber has been properly compounded it is machine cut into pieces of the approximate shape of the finished product and of sufficient quantity to just fill the mold. The molds are then pressed between the jaws of a hydraulic press where they are subjected to temperatures sufficiently high to cure or vulcanize them in the mold. Hollow molded rubber goods are made hollow by compressed air. Samples of this class of work are rubber balls, dolls, and toy animals.

It is evident from the above description that the only machinery involved in this work is the hydraulic press. The movement of the plungers is very slow, not exceeding 20 feet per minute and it is deemed unnecessary in many plants to lubricate them. Others, however, use soapy water in the pressure system. By this last method, a little soap is carried between the plunger and the packing on the upward stroke. But before the plunger returns all of the soap and water have been thoroughly evaporated so that the plunger is not lubricated on the downward stroke and very little, if any on the upward stroke. A lubricant which would protect both plunger and packing and would maintain an oily film on the plunger for a reasonable length of time, should be used for this purpose. This lubricant should be heat-resisting, and have a very low evaporating factor.

Tubing

The last major method of forming rubber products which we will discuss is that called "tubing." The compounded rubber is first warmed up on a mill to about 150° F. and then cut from the mill in a sheet, rolled up and fed into the tube machine. This machine is built after the principle of a meat grinder, a screw forcing the work forward through a die, which gives the stock the desired shape. The machine is fitted to further heat the work while going through the screw and still further when passing through the die. Solid tires for carriages and automobile trucks are made this way, as are also all rubber small hollow tires. All goods having a small fixed cross section, not employing fabric, among which is rubber tubing, can be manufactured by this method.

The lubrication of these machines is fairly simple as only the small gears and plain bearings incorporated in their design need this attention. The same gear lubricant used on the gears already referrea to may be used here also. A thin coat is generally applied with a brush. The shaft bearings are either plain or ring type for which a well refined, medium bodied, red engine oil is entirely suitable.

Vulcanizing

It was stated above that molded goods are vulcanized in the molds in which they are formed. Goods manufactured by any of the other processes are vulcanized after the product is formed. By vulcanization is meant the process of pressure and heat treatment to which the rubber goods are subjected and by which they become indifferent to moderate temperature changes. By this process another effect is accomplished in that goods made of several plies of rubber, or "friction," have the composite parts solidly united. Vulcanized rubber will also withstand those enemies of raw rubber —light and heat—without decomposition. The true action of the process has never been fully understood, but like many other natural laws it is used without true theoretical comprehension.

The only machinery used in the process is the hydraulic press. One of the types used is

shown in the illustration. The platens are sometimes cast hollow and fitted with steam connections. The work is placed in molds which conform with their shapes and, as before stated, are subjected to heat and pressure treatment for a period depending on their compounding and physical nature. The lubrication of presses was treated above in discussing molded goods. The lubrications of these presses does not differ from that discussed in that section.

Miscellaneous Machinery

Beside the machinery mentioned above, there are many machines of special types, such as sewing machines, golf ball center machines, battery jar drilling, tire, brading, cablers, wrapping, brushing machines, Brownell twisters, polishers, grinders and others. The lubrication of these machines is not difficult as they are all light, fast-running units and in general the only requirement is a well refined light or medium bodied red engine oil. There are also many machines and engines found here which are not peculiar to rubber plants so that they need not be discussed here. The big manufacturers have large refrigerating plants, extensive pumping, pressure and air compressor systems and, of course, machine shops, and power departments. Of each of these articles could be written.

But a discussion of rubber plant lubrication would not be complete at this time if the lack of standard lubricating practice passed unnoted. At this time the personnel in charge of the lubrication of the various rubber plants have differing ideas about the proper lubricants to use and guard their information closely. The result is that one cannot state the very best practice, not even the lubricating engineers of the large manufacturers, as it has been impracticable for them to try all types of lubricants and all methods of application. The greatest good will come to all, large and small, when the engineers of the various rubber companies combine for the threshing out of the subject and cooperate with the machinery manufacturers and the oil producers to secure the very best machinery design and determine on the specifications of the perfect lubricants.

A Modern Oil House

(SANTE-FE RAILROAD)

Too many engineers believe that when they have successfully determined the proper lubricants to use on the machines placed in their charge that their duties in the lubricating line have ceased and everything will operate smoothly.

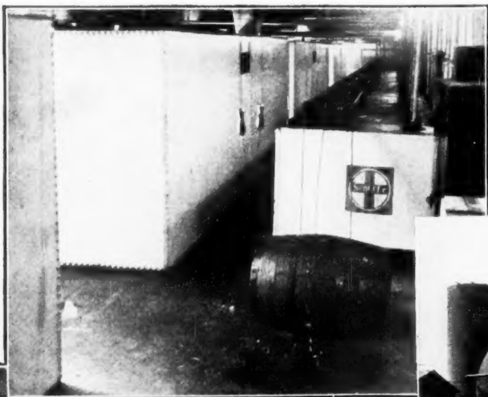
Many a lubricating system has failed due to the fact that the application of good and proper lubricants is left to the caprice of an uninterested and slothful oiler whose only redeeming characteristic is that he does not demand much pay.

For the sake of safety he is given an oil house in which to store the lubricants but no particular care is taken in its design or arrangement. It apparently is assumed that the place is going to be sloppy anyway and that it is money wasted to try to make it otherwise. This careless attitude on the part of executives naturally is not conducive to developing a careful attitude on the part of an oiler. It is not surprising that many oil houses are littered up and that mistakes are made when proper means are not taken to keep the place orderly and the various lubricants segregated. It is more surprising how many oilers rise above the situation and keep an oil house spic and span in spite of the lack of proper facilities. An orderly oil house breeds a careful oiler and soon pays for itself in the decrease of mistakes. That many executives realize this is shown by some oil houses which we have seen, one of which we will describe in the belief that no matter how perfect a system may exist some other fellow may have a feature that may be of interest.

The A. T. & S. F. Oil House at their Topeka Shops is unquestionably one of the most complete and modern railway oil houses in the country. This is the disbursing center for all lubricants, oils, paints, waste and similar products used on the Santa Fe Proper, which

A MODERN OIL HOUSE

I



II

III

IV

The
A. T. & S. F. OIL HOUSE
at the TOPEKA *Shops*

PHOTOGRAPH NO. I

Interior of basement row of 10,000 gallon tanks, small tanks for barrel goods and also lift and tracks for emptying barrels. Small black squares on large tanks are signs indicating kind of oil contained. Chains and handles operating air lift at left of small tanks.

PHOTOGRAPH NO. II

Oil house platform. Air pump on truck at end of platform.

PHOTOGRAPH NO. III

Interior of Oil House showing battery of steam pumps with measuring pumps in the background at the right.

PHOTOGRAPH NO. IV

Oil house, tracks and tank cars viewed from storehouse platform. Tanks shown at left of TCX 7041 are Santa Fe transportation tanks.

excludes the Coast Line and a portion of the lines in Texas which are supplied direct from the refinery.

The building is a one-story concrete structure 150 feet by 60 feet with a basement occupying the same area. Loading platforms on each side extend the entire length of the building. In the basement are the oil storage tanks as well as ample space for barrel and package storage. The main floor is given to the pump batteries, waste bins and miscellaneous supplies while a corner is partitioned off as an office.

In the basement are located thirteen 10,000-gallon tanks. Five are used for Car Oil, two for Gasoline, two for Long Time Burning Oil, and one each for Signal, Mineral Seal, Headlight and Valve Oil. Two auxiliary storage tanks, located outside the oil house and of the same capacity are also used for Headlight Oil. The tanks used for Car and Valve Oil are steam heated to insure ease of handling in cold weather. The basement also contains 25 small tanks for barrel goods. Sixteen of these are 320 gallons capacity, six of 220 gallons, and three of 1,000 gallons.

The method of unloading barrel shipments is illustrated in photograph No. 1. The barrel is rolled on the cradle and elevated by means of an air lift to the tracks extending along the tops of the tanks. It is then rolled directly over the man-hole of the proper tank, the bung removed, and the oil allowed to drain through a pan containing a screen of small mesh wire, directly into the tanks. These tanks are used for the storage of Shop Oils, Linseed and Paint Oils, Turpentine, Denatured Alcohol, Disinfectant, and Liquid Soap.

Tank car shipments are unloaded into storage tanks or else transferred to transporting tank cars by means of a battery of 7 Knowles steam pumps. This can be done in three hours' time after the tank car is set. Two air pumps mounted on trucks are also used in unloading, one of them may be seen at the far end of the platform in photograph No. 2. One being used for Car and Valve Oil and the other for Burning Oils and Gasoline. These pumps are especially valuable in handling bad order cars. They also take suction from the various storage tanks and are used in loading tank cars or barrel lots for shipment.

A battery of Bowser self-measuring pumps (1 gallon to ½ pint per stroke) is used in connection with the storage tanks for handling small amounts. All tanks are equipped with gauge floats which register the amounts in storage on gauge sticks located on the main floor of the oil house.

Six small Knowles steam pumps are used for filling barrels and drums for shipment to various shops and points where the consumption is too small to warrant the use of storage tanks.

All suction and discharge piping and hose is painted a distinguishing color to correct any possibility of contaminating the oil to be handled. The colors are as follows:

Car and Valve Oil: Aluminum Bronze
Kerosene: Green
Signal and Mineral Seal Oil: Yellow
Long Time Burning Oil: White
Gasoline: Red

Locomotive greases are received in car-load lots and are made up into cakes as needed. About 50 barrels of each are used a month. They are stored in the basement where a press makes cakes of driving journal compound (7 to 27¾ lbs.) as required.

Thirty-eight 10,500-gallon transportation tank cars are operated at this point. These cars are stencilled "Stores Department, Topeka, Kansas," and are painted with bands of distinguishing color to mark the various products. Valve and Car Oil tanks are equipped with heater coils.

The Valve Oil cars are stencilled "For exclusive use of Valve Oil only" while the Kerosene cars are branded likewise for Kerosene. Some of these cars may be seen in photograph No. 2 and No. 4. The cars and colors used are as follows:

6 cars yellow	bands for Valve Oil
8 cars yellow	bands for Car Oil
11 cars white	bands for Kerosene Oil
4 cars white	bands for Signal Oil
9 cars red	bands for Gasoline

While a small oil house may not need the variety of equipment described above yet many features are applicable. Oils are better stored in tanks beneath the floor, but supplied with gauges, than in barrels. Measuring pumps are an advantage though not, of course, necessary. Where several kinds of oils are used with the same type of pumps, color systems of pipe painting assist in preventing mistakes. Open barrels containing greases should have covers. Barrels should be labeled in large letters or with distinctive colors. Waste oil should not be poured back into storage tank except that coming directly from the faucet or outlet pipe. Above all, floors should be kept clean and loose oil out of sight. A neat orderly oil house is just as necessary as a polished machine and is the mark of economy and efficiency.

Care of Street Railway Equipment

In the lubrication of rolling equipment of electric street railways the fact is frequently evidenced that in the minds of those in charge of equipment the chief cause of hot or burned out bearings must lie in the lubricant, and this in many instances being an error, has a direct and most important effect on the cost of maintenance.

If not audibly expressed it is often in the thoughts of those in charge that the Lubrication Engineer, in laying the cause of trouble to some mechanical or material defect, or condition, he is making some pretense of defense of his lubricant, and an old saying, "A poor mechanic and his tools" immediately comes to mind. Supposing, however, it were considered that a good mechanic takes care of his tools? It is safe to presume he would command more attention when bringing to notice the poor condition of tools which are all too often given him to work with in order to produce the desired results from his lubricant.

As nearly all shopmen will agree, it is almost beyond a possibility, after a bearing has been burned, to tell the exact cause. If, on the other hand, a bearing should heat, and the cause could be found before too late, would it not be economy in maintenance to locate and correct it rather than lay fault to lubrication or lack of lubrication, to dose the bearing with oil and eventually loose the bearing and possibly the armature? Either event increases maintenance cost and taking equipment out of service, with resultant loss of revenue.

Let us take two important factors in lubrication, for the time forgetting the lubricant, and see if there is not a big element in each which directly concerns maintenance.

If it were always kept in mind that a sparking motor produces heat it would naturally occur to mind that the heat so produced must go somewhere, and somewhere is most likely to be the armature shaft and bearings. Taking the factors most likely to produce this heat and we find:

Weak brush springs. Brushes not properly spaced. Loose cable connections. Weak fields. Pole pieces not tightly bolted. Rough commutator. Dirty Commutator. Loose segments. Etc.

In the bearings themselves there are to be found some of the following causes:

Insufficient clearance in fitting bearings. Uneven shafts. Worn dowel pins and dowel pin holes. Abrased shaft or bearing where improper tools have been used for packing. Babbitt too hard or too soft. Babbitt heated to too high a temperature in pouring. Improper pouring. Babbitt remelted too often without additional new metal. Babbitting out of round.

In the packing of bearings there are to be found these causes:

Too frequent change in oilers and those in charge of inspections. Indiscriminate packing of motors. Jamming waste too tight in receptacles. Using any tool which may be handy. Laying waste on floors or truck frames. The use of pails or cans which are dirty or have contained foreign materials such as paint or varnish.

Let us now suppose the bearings have been properly packed and that an electrical heat is suddenly generated from one of the motor troubles enumerated and is transmitted to the bearing. The equipment must be kept on the road at least until it is returned to the barn or shop. To do this the bearing is dependent on the amount of lubrication which it receives in excess of that usually required, and there must be some means by which the lubricant can reach the bearing, and that is through the waste packing. When the waste packing fails we have to consider what that failure was caused by, and we are most likely to find the following:

Waste has been purchased not with a view to the absorption qualities, that of holding sufficient oil. Its capillarity has been overlooked, the power to convey against gravity. Its resilience, the property of expansion. Its uniformity, the capacity to respond or function in every portion, and not interrupt the passage of the oil. Its proportion of mixture. Its strength of thread. Its permanence in service, the mileage it will give. Its property of reclaimation. It has been purchased for its price per pound.

It is for these few facts that the lubricant must take the responsibility of keeping your car on the road. It is these facts, these defects, these tools, with which the lubricant must work with and overcome. It must become a doctor where a major surgeon is needed.

EDGAR C. RUWE COMPANY
INCORPORATED
New York, N. Y.